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(56) Documents Cited
EP 0329524 A1 US 4494198 A

(58) Field of Search
UK CL (Edition O) **G4A ACX ADT AUXS AUXX**
INT CL⁶ **G06F 15/02 17/00**
On-line : **WPI, COMPUTER**

(54) **Ballistic calculator**

(57) A ballistic calculator, pocket sized, that when loaded with trajectory and wind drift data derived from firing tests, ballistic tables or computer predictions, will, when used in the field modify the data to give the user actual sight settings at each entry of site environmental and target orientation data requested in the display.

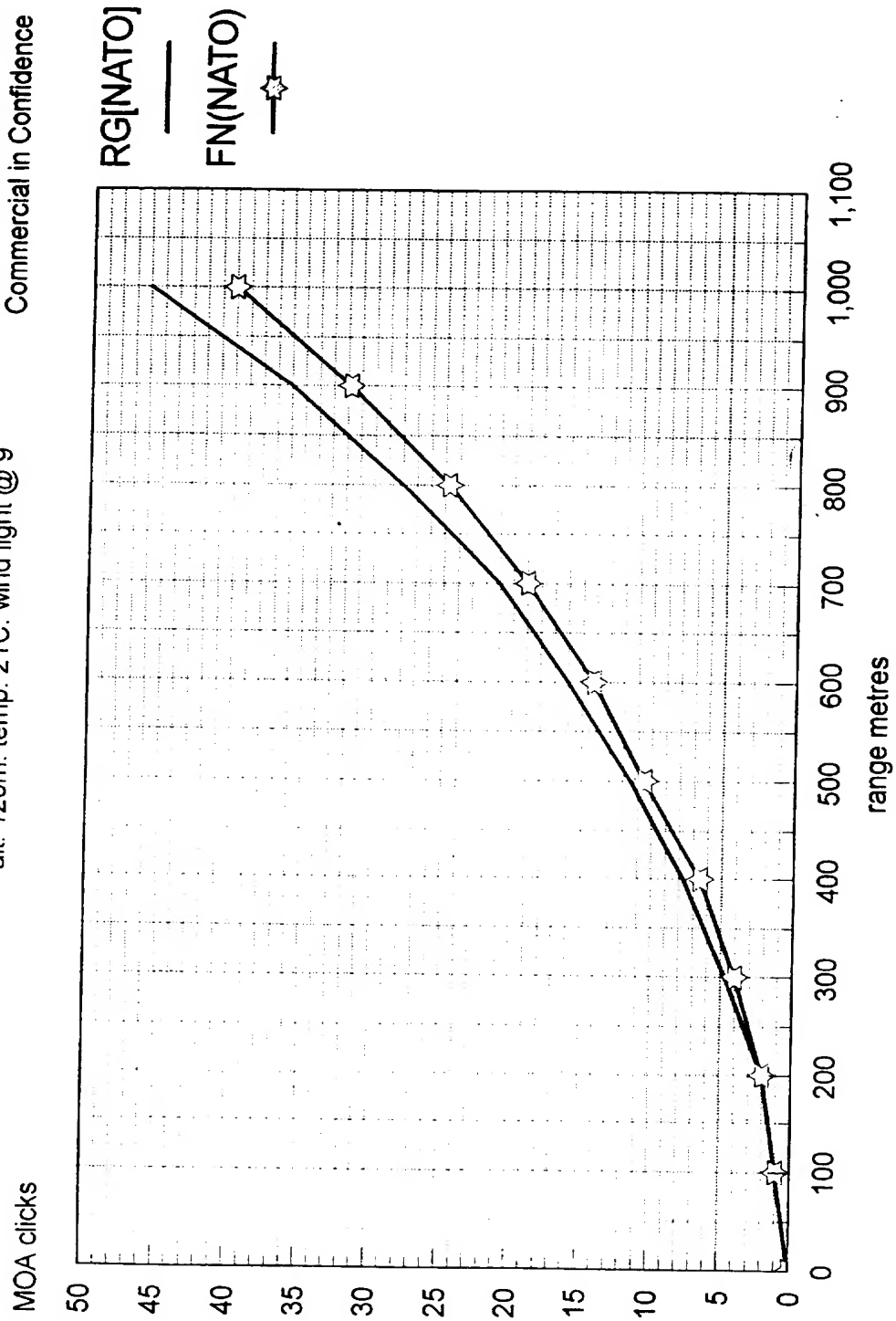
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TRAJECTORY CURVE-L96 No. 0942/6X42 SuB

ammo RG Lot 29.6.87y & FN Lot 88.90w

alt. 120m. temp. 21C. wind light @ 9

Accuracy International Ltd
Commercial in Confidence



BALLISTIC CALCULATOR TABLE

ELEVATION CORRECTIONS										Ballistic Table 'Wind Drift'				Wind Drift Corrections	
BALLISTIC TABLE 'ELEVATION'		AW/HPS @ 30M ALT, TEMPERATURE 68F (20C)		UPHILL / DOWNHILL FIRING ANGLE, ALWAYS - (MINUS)		Altitude correction per 1000m		Temperature correction per 40 Degs C		Wind correction		Ballistic Table 'Wind Drift'		Wind Drift Corrections	
												AW/HPS @ 30m Altitude Temperature 68 Degs F (60 C) @ 10 m.p.h.		Altitude correction per 1000m	
RANGE M	RISE FROM 'ZERO' MOA	30 Degs X 0.9	45 Degs X 0.7	60 Degs X 0.5	higher - lower +	higher - lower +	tail - head +	Clock 3 & 9 full value, i.e. x 1.0	Clock 2, 4, 10, 8, x 0.9	Clock 1, 5, 11, 7, x 0.5	Altitude correction per 1000m up - down +	Temperature correction per 40 Degs C up - down +	Altitude correction per 1000m up - down +	Temperature correction per 40 Degs C up - down +	
100	0	0	0	0	-	-	-	1.0	1.0	0.5	-	-	-	-	
200	2	2	1.5	1.0	-	-	-	1.5	1.5	1.0	-	-	-	-	
300	4	4	3.0	2.0	-	-	-	2.0	2.0	1.0	-	-	-	-	
400	7	6.5	5.0	3.5	-	-	-	3.5	3.0	1.5	0.5	0.5	0.5	0.5	
500	11	10.5	7.5	5.5	0.5	0.5	-	4.5	4.0	2.0	0.5	0.5	0.5	0.5	
600	16	14.5	11.5	8.0	1.0	1.0	-	5.5	5.0	2.5	1.0	1.0	1.0	1.0	
700	21.5	19.5	15.0	11.0	1.5	1.5	0.5	7.0	6.5	3.5	1.0	1.0	1.0	1.0	
800*	27.5*	25.0	19.0*	14.0	2.0*	2.5*	0.5*	8.5*	8.0	4.0	1.5*	1.5*	1.5*	1.5*	
900	35.0	31.5	24.5	17.5	3.5	4.0	1.0	10.5	9.5	5.0	2.0	2.0	2.0	2.0	
1000	45.5	41.0	32.0	23.0	5.0	6.0	1.0	12.5	11.5	6.0	2.0	2.0	2.0	2.5	
1100	58	52.5	40.5	29.0	7.0	8.5	1.5	16.0	14.5	8.0	2.5	2.5	2.5	3.0	

QUESTION:

What settings are needed for a shot at 2000m altitude, at 45 degrees uphill with a temperature of zero degrees C and the wind from 11-o'clock at 20 m.p.h?

RANGE CALCULATION

Range 800m
Up/Down correction 45 Degs (x0.7) =
Altitude correction 2000m
Temperature correction 0 Degs C
Wind angle correction 11-o'clock

ELEVATION SETTING

+ 16.5 MOA

WIND

CALCULATION

Strength 20mph
Altitude 2000m
Temp. Corr. 0 Deg C
Sub total
Wind angle 11-o'clock
WIND SIGHT SETTING

ACCURACY INTERNATIONAL - COMMERCIAL IN CONFIDENCE

Ballistic Calculator

This invention solves the problems faced by the marksman of hitting the target with the first shot by:

- a) Integrating all the relevant factors electronically
- b) Giving the marksman simple sight corrections at the relevant 'prompt'; and input of environmental information
- c) To allow the marksman to access the information in an, easy, foolproof way, i.e. to save him having to do calculations in the field.
- d) To provide the capability to give the necessary information in a rugged, portable package, that can be carried by the marksman in the field
- e) To provide a record of the settings used
- f) To provide the possibility to interface or combine with sights/weapons

This invention concerns the enclosure in a small, rugged, calculator, the mathematical capability to give a marksman his sight settings.

This information is given after entering the range, in metres or yards, to the target. The calculator then asks a series of questions which includes the following:

Distance Range to target
Uphill/downhill angle
Altitude
Temperature
Wind direction
Wind strength

At each question the calculator will give the setting in 'clicks', MILradians, or minutes of angle from a 'zero' setting (the position or range at which the sights were sighted in and the calibration drums or reticle were moved to correspond).

The calculator will be programmed prior to normal use with the trajectory co-ordinates which are obtained from ballistic tables, computer programmes or live firing zeroing exercises. The information programme would be range vs clicks/minutes of angle/MILradians.

The 'chip' will calculate a 'fair curve' through the zeroing points which will form the basis of all future computations. It will, in addition to the 'output calculations' mentioned above, automatically calculate the 'magnus' or 'drift' effect of a rotating body and include this in the answers given.

The invention will also include the capability that, on completion and acceptance of a calculation, the details and criteria can be added to the memory for recall at a later date.

The calculator may also have built in a capability for measuring the following:

- a. Altitude
- b. Temperature
- c. Uphill/downhill angle
- d. Azimuth
- e. Hit probability based on the known intrinsic accuracy of the weapon/ammunition combination being used.

The calculator would have the capability of being built into or incorporated in:

- a. telescopic sight
- b. laser range finder
- c. thermal imaging sight
- d. image intensifying sight
- e. wind gauges and instruments
- f. a small arm (pistol/rifle/grenade launcher/longbow/crossbow
- g. a combination of any or all of the above.

Details regarding the calculations performed by this invention are enclosed for information and they include a trajectory curve and a ballistic table.

The procedure for use typically is as follows:

1. To obtain 'base line' data, on the zeroing range enter -
 - a. Enter range vs sight adjustments (clicks/MOA/MILradians)
 - b. Enter wind drift - full value in clicks/MOA/MILradians at, say, 10km/h from 9 or 3-o-clock (90 degrees or 270 degrees azimuth)
 - c. Enter temperature
 - d. Enter altitude
 - e. Enter uphill/downhill angle
 - f. Enter date
 - g. Enter weapon type and number
 - h. Enter sight number
 - i. Enter ammunition type and lot number
 - j. On completion, commit to memory
2. In the field, with the same g, h, i above, the invention is used by answering the questions a-f above. At each entry, the elevation and windage correction will be displayed.

The calculator will have the capacity for holding data for several ammunition types in the same weapon/sight combination.

CLAIMS

1. A ballistic calculator that is a pocket sized, hand held electronic unit specifically designed to provide the marksman's sight settings for elevation and azimuth (windage) in angular MILS/MOA or 'clicks' according to the input of environmental conditions and target orientation at each firing sight.
2. A ballistic calculator, as claimed in Claim 1, that is programmed/set up/calibrated prior to field use with trajectory and wind drift co-ordinates which are obtained from ballistic tables, computer programmes or live firing zeroing exercises.
3. A ballistic calculator, as claimed in Claim 1 and Claim 2, that provides the 'come-ups' or 'setting' or 'elevation' in angular form or clicks from an established zero setting or base line which corresponds with the zero setting or base line in or on the sighting system.
4. A ballistic calculator, as claimed in Claim 1 or Claim 2 or Claim 3, that will provide a wind deflective readout in angular form or clicks with each elevation readout given.
5. A ballistic calculator, as claimed in Claim 1, 2, 3 and 4 that will calculate and show an elevation and wind deflection readout at the input of any relevant information prompted, at each entry of relevant information requested or 'prompted'.
6. A ballistic calculator, as claimed in Claim 1, 2, 3, 4 and 5, that will automatically carry out computations to integrate drift caused by a spin stabilized projectile and show this in each readout.
7. A ballistic calculator, as claimed in Claim 1, that will record 'saved' data to memory for recall later.
8. A ballistic calculator, as claimed in Claim 1, wherein environmental gauges are built in and integrated with the microprocessor and these will include range, altitude, temperature, uphill/downhill angle and azimuth.
9. A ballistic calculator, as claimed in Claim 1, wherein a 'hit probability' function is built in to the microprocessor.
10. A ballistic calculator, as claimed in Claim 1, wherein is built adaptation capability to be added in to or integrated with weapons, sighting systems or environmental measuring equipment.



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Claims searched: 1-10

Examiner: B.G. Western
Date of search: 15 January 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G4A ACX ADT AUXS AUXX

Int Cl (Ed.6): F41G 3/00 3/14 ; G06F 15/02 17/00

Other: On-line : WPI, COMPUTER

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	EP-0329524-A1 THOMSON-CSF See whole document	-
A	US-4494198-A SMITH et al See whole document	-

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.
& Member of the same patent family

A Document indicating technological background and/or state of the art.
P Document published on or after the declared priority date but before the filing date of this invention.
E Patent document published on or after, but with priority date earlier than, the filing date of this application.